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(54) **Agglomerated abrasive device particularly for tumbling and the like, and manufacturing process.**

(57) Agglomerated abrasive device particularly for tumbling and the like, whose peculiarity consists of the fact that it comprises an element which has a preset geometric shape. The element comprises powdery abrasive means and granular abrasive means embedded in binding means.

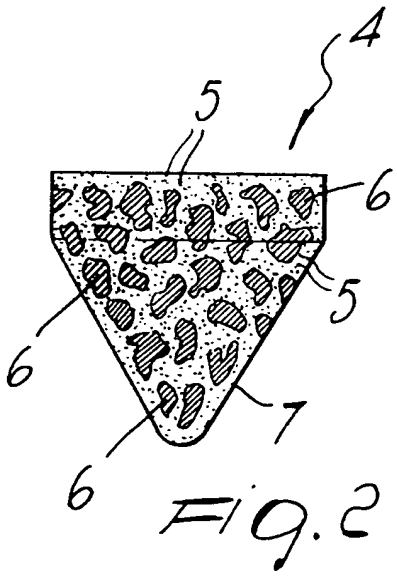

Fig. 2

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The present invention relates to an agglomerated abrasive device particularly for tumbling and the like and to a manufacturing process.

The mass tumbling of surfaces, which consists in deburring, polishing and honing surfaces which are usually but not necessarily metallic, usually uses abrasive grains in which the parts to be processed are immersed; the parts are moved inside appropriate machines.

The friction due to the relative movement between the parts to be processed and the abrasive grains causes deburring, polishing and honing, according to the type of abrasive used, possibly with the addition of appropriate chemical additives.

It is evident that the geometric configuration and the grain size of the abrasive grains used, as well as their physical nature, are fundamentally important.

Up to a few decades ago, natural abrasives, i.e. rocks and natural minerals of various kinds, appropriately granulated so as to obtain small pebbles, were used almost exclusively. By choosing the types of rock and mineral, abrasives having different hardnesses were obtained for the different types of processing to be performed and therefore so as to have a wide range of abrasives available.

The greatest problem of these abrasives is linked to the enormous difficulty in obtaining granules of uniform and constant shape, whereas granule size could always be made uniform by using screens of different mesh to select the granules. The non-uniformity of the shapes caused, as a secondary problem, the possibility of the jamming of granules inside blind holes, in addition to the possibility, due to the shape of the granules, of the lack of processing on particularly narrow-angled recesses.

Another problem is related to the hardness of the granules, which usually had a relatively high lower hardness limit, preventing their efficient use in the case of relatively soft and elastic materials to be treated, which caused the well-known effect of surface pitting.

A marked improvement has been obtained with so-called synthetic abrasives, wherein abrasive powders, such as pulverized pumice, corundum, silica and the like, are mixed with a binder, forming a mixture which can be given a preset and constant shape, such as cones, pyramids, triangular prisms and the like, subsequently curing said binder so as to produce preformed abrasive granules of substantially constant quality and shape.

Two types of preformed abrasive have become commercially popular: ceramic-binder preformed abrasives and plastic-binder preformed abrasives.

Ceramic-binder preformed abrasives are obtained by mixing the abrasive powder with a ceramic paste, thus obtaining a mixture which can be formed easily. Usually, this mixture is extruded through dies of appropriate shape and size, i.e. for example triangular, star-shaped, cylindrical and the like, cut into segments of appropriate length and then baked in kilns at high temperature, i.e. approximately 1300° Celsius. The finished granules are very hard, have a precise and constant shape and have characteristics similar to natural abrasives, although the abrasive powder is dispersed within the entire mass of the granule.

Plastic-binder preformed abrasives are produced by mixing the abrasive powder with a synthetic resin which is poured into molds after mixing. Due to either the temperature or appropriate catalysts, the resinoid binder is made to cure, obtaining granules which have substantially constant shape and dimensions and have a specific hardness which is lower than that of granules with ceramic binder.

Despite the considerable commercial success obtained, even these granules are not free from more or less severe problems. For example, the high cost of the synthetic materials causes a relatively significant cost of plastic-binder preformed elements.

The aim of the present invention is to eliminate or substantially reduce the problems described above in known types by providing an agglomerated abrasive device particularly for tumbling and the like which allows considerable cost savings with respect to so-called plastic-binder preformed elements.

Within the scope of the above aim, an object of the present invention is to provide an agglomerated abrasive device which eliminates the problems related to the shape of natural abrasive granules.

Another object of the present invention is to provide an agglomerated abrasive device whose hardness is intermediate between ceramic-binder and plastic-binder preformed elements.

Not least object of the present invention is to provide an agglomerated abrasive device which is relatively easy to manufacture and at competitive costs.

This aim, these objects and others which will become apparent hereinafter are achieved by an agglomerated abrasive device particularly for tumbling and the like, characterized in that it comprises an element which has a preset geometrical shape, said element comprising powdery abrasive means and granular abrasive means embedded in binding means.

Further characteristics and advantages of the invention will become apparent from the description of a preferred but not exclusive embodiment of an agglomerated abrasive device particularly for tumbling and the like according to the invention, illustrated only by way of non-limitative example in

the accompanying drawings, wherein:

figure 1 is a sectional view of a known plastic preformed element;

figure 2 is a sectional view of an embodiment of an abrasive device according to the invention;

figure 3 is a sectional view of a preformed element whose granules are much harder than the resin in which they are embedded;

figure 4 is a sectional view of a preformed element whose granules are much softer than the resin in which they are embedded; and

figure 5 is a sectional view of a preformed element which has correct wear.

With reference to figure 1, said figure illustrates a known plastic preformed element 1 which has granules 3 of abrasive material, such as silica, corundum, pumice and the like, embedded in a synthetic resin 2.

An agglomerated abrasive device particularly for tumbling and the like according to the invention, illustrated in sectional view in figure 2, comprises an element 4 which has a preset geometric shape, such as cones, cylinders, triangular prisms and the like.

The element 4 comprises powdery abrasive means, constituted by granules 5 of pulverized abrasive material of the above mentioned types, and granular abrasive means, constituted by granules 6 made of natural material or of natural granular material, embedded in binding means constituted by a synthetic resin 7.

The abrasive powder 5 and the granules 6 are dispersed uniformly in the synthetic resin 7.

The synthetic resin 7 can be cured either by heat or by means of appropriate catalysts.

The natural abrasive granules 6 can be constituted by arenites or, as will become apparent hereinafter, by fragmented used plastic preformed elements or other natural rocks having similar hardness and resilience characteristics.

Experimental tests, by means of which the preformed elements illustrated in figures 3 and 4 were produced, have led to the choice of the above mentioned particular type of rock. In fact, by using materials used in the past for so-called natural abrasives, excessive hardness of said materials was observed; said materials wear much more slowly than the synthetic resin 7 and therefore they allow the escape of points, which can damage more or less significantly the parts being treated, from the abrasive device.

By testing other types of abrasives already used, for example as powders, the opposite effect was observed, as shown by figure 4; i.e., the natural abrasive granules 6 wore much faster than the synthetic resin 7, producing recesses in which dirt deposits, preventing the correct use of the abrasive devices according to the invention.

With the solution illustrated in figure 5, which is in practice the device of figure 2 after some use, so-called arenite was chosen; arenite is a sedimentary rock which was formed at great depths, approximately 3000 meters, and was thus subjected to enormous pressures and, due to positive orogenesis, has resurfaced in some limited and well-determined regions of the earth's crust, hence its relative rarity.

It has in any case been advantageously observed that used plastic preformed elements, i.e. the remainder of a load of abrasive devices according to the invention, or known plastic preformed elements, can be recycled in order to obtain the granules 6 in addition to arenites.

In this manner, conveniently, various results are achieved, such as the elimination of a large amount of industrial waste which requires a particular treatment for its disposal, the decrease in the production costs of the abrasive devices according to the invention, since they are recycled raw materials which have a relatively low recovery cost, and finally the possibility of recovering said used preformed plastic elements directly from the users.

In order to provide agglomerated abrasive devices according to the invention, it is possible to use the process which comprises the following steps:

-- mixing step, during which, starting from basic substances, such as polyester, urea-formaldehyde and the like, mixed together, the synthetic resin 7 is prepared and abrasive powder 5 is added to said resin in order to obtain a uniform pasty liquid;

-- dosage step, wherein the uniform pasty liquid is metered into molds, which are filled with said liquid up to approximately half of their volume;

-- natural granular material introduction step, wherein the molds are filled with the natural granular material;

-- mixing step, during which the molds are subjected to vibration in order to obtain the precipitation of the granules 6 of the natural granular material into the uniform pasty liquid in order to obtain a uniform mass without concentrations of one of said elements in particular points of the molds.

The process can then continue with the following steps:

-- curing step, during which the uniform pasty liquid, in which the natural granular material is mixed, is polymerized by heating until the synthetic resin 7 is obtained;

-- final step, during which the abrasive devices 4 are extracted from their respective molds after they have been allowed to cure.

Another embodiment of the process provides for the following step between the dosage step and

the natural granular material introduction step:

-- heating step, during which the natural granular material is pre-heated in order to reduce the polymerization time of the uniform pasty liquid.

In this embodiment, after the mixing step the process provides for the following steps:

-- curing step, during which the uniform pasty liquid is polymerized at low temperature by means of the heating caused by the uniform granular material;

-- final step, during which the abrasive devices 4 are extracted from the molds after they have been allowed to cure.

A further embodiment of the process provides for the following step between the dosage step and the natural granular material introduction step:

-- catalyst step, during which the natural granular material has an appropriate amount of catalyst added thereto in order to cure the uniform pasty liquid.

In this embodiment, after the mixing step the process has the following steps:

-- curing step, during which the uniform pasty liquid is polymerized at low temperature by mixing with the catalyst;

-- final step, during which the abrasive devices 4 are extracted from the molds after they have been allowed to cure.

Conveniently, the result is that the abrasive devices 4 can be produced both at high temperature and at low temperature, using the various polymerization methods described above.

Advantageously, the described process can be performed with known machines, without completely revolutionizing the production cycle provided for known preformed plastic elements.

The following examples illustrate some methods of manufacturing the agglomerated abrasive according to the invention:

Example 1.

a) A mixture in the ratio of 1:1 by weight of non-polymerized polyester and powdered quartz is prepared, to obtain a flowable and homogeneous fluid;

b) 0.2 - 0.8 percent by weight of a heat polymerization agent or heat activated catalyst is added to said mixture (a).

c) The mixture is mixed in a suitable drum mixer. Granulated arenite, having dimensions or granulometry from 1 to 8 mm, is added. The ratio of the mixture (a) to arenite is preferably between 1:1 and 1:0.5. In order to increase the wetting or hydro-absorbability of the granules, thereby also increasing the adhesion of the granules to the resin, a known surfactant substance can be added to the mixture (a) to modify the surface tension and improve the quality of the finished product.

d) The mixture thus obtained is poured into molds of the desired shape (for example cones having a base diameter of 40mm and a height of 45mm).

e) The molds are heated to a temperature in the range of 90 to 110 degrees Centigrade for a time period of from 8 to 15 minutes, in order to achieve hardening of the molded products.

f) Upon completion of the hardening step, demolding is effected, for example, by turning the molds upside down in order to extract the products therefrom.

The above method can be carried out in a fully automated manner.

Example 2.

a) One proceeds with the steps (a) and (b) described heretofore in example 1.

b) The mixture is poured into a mold such that the mixture occupies from 50 to 70 percent of the useful volume of the mold.

c) The empty part of the mold is filled with granulated arenite (which may be optionally preheated in order to reduce the time required to effect hardening).

d) The mold is vibrated to cause penetration of the granulated material into the fluid mixture.

e) One proceeds with steps (e) and (f) described heretofore in example 1.

Example 3.

One proceeds by carrying out the method steps described heretofore in example 2, with the following variations:

a) An "ambient temperature"-type catalyst is added to the mixture obtained by proceeding with the steps (a) and (b) described heretofore in example 1 (in order to initiate hardening in this example, as known, hardening-accelerating agents can be added, such as cobalt naphthenate, specific amines etc.).

b) Said accelerators are sprayed onto the granulated arenite before introducing it into the molds.

It has been observed that the invention achieves the intended aim and objects, constituting an abrasive device which is capable of perfectly replacing known ceramic and plastic preformed elements, furthermore advantageously reducing the amount of synthetic resin used at least by 40-50% and consequently reducing costs. Furthermore, as previously mentioned, it is possible to recycle used plastic preformed elements as granules 6, further reducing the production costs of devices according

to the invention.

The invention thus conceived is susceptible to numerous modifications and variations, all of which are within the scope of the inventive concept.

All the details may furthermore be replaced with other technically equivalent elements.

In practice, the materials employed, as well as the dimensions, may be changed in any manner according to the requirements.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Agglomerated abrasive device particularly for tumbling and the like, characterized in that it comprises an element which has a preset geometric shape, said element comprising powdery abrasive means and granular abrasive means embedded in binding means.

2. Agglomerated abrasive device according to claim 1, characterized in that said powdery abrasive means comprise abrasive powder which is uniformly dispersed in said binding means.

3. Agglomerated abrasive device according to the preceding claims, characterized in that said granular abrasive means comprise granules of natural abrasive materials uniformly dispersed in said binding means.

4. Agglomerated abrasive device according to one or more of the preceding claims, characterized in that said binding means comprise synthetic resins which can be cured selectively by heat and by means of catalysts.

5. Agglomerated abrasive device according to one or more of the preceding claims, characterized in that said natural abrasive granules are constituted by arenites.

6. Agglomerated abrasive device according to one or more of the preceding claims, characterized in that said natural abrasive granules are constituted by fragmented used plastic preformed elements.

7. Manufacturing process for agglomerated abrasive devices, characterized in that it comprises the following steps:
   -- mixing step, during which, starting from basic substances mixed together, the synthetic resin is prepared and abrasive powder is added thereto in order to obtain a uniform pasty liquid;
   -- dosage step, during which said uniform pasty liquid is metered into molds which are filled up to approximately half of their volume with said uniform pasty liquid;
   -- natural granular material introduction step, during which said molds are filled with said natural granular material;
   -- mixing step, during which said molds are subjected to vibration in order to obtain the precipitation of granules of said natural granular material into said uniform pasty liquid in order to obtain a uniform mass without concentrations of one of said elements in particular points of said molds.

8. Process according to claim 7, characterized in that it comprises the following steps:
   -- curing step, during which said uniform pasty liquid, in which said natural granular material is mixed, is polymerized by heating;
   -- final step, during which the abrasive devices are extracted from said molds after they have been allowed to cure.

9. Process according to claim 7, characterized in that it comprises the following step between said dosage step and said natural granular material introduction step:
   -- heating step, during which said natural granular material is pre-heated in order to reduce the polymerization time of said uniform pasty liquid.

10. Process according to claim 9, characterized in that it comprises the following steps after said mixing step:
    -- curing step, during which said uniform pasty liquid is polymerized at low temperature by means of the heating provided by said uniform granular material;
    -- final step, during which the abrasive devices are extracted from said molds once they have been allowed to cure.

11. Process according to claim 7, characterized in that it comprises the following step between said dosage step and said natural granular material introduction step:
    -- catalyst step, during which said natural granular material is wet with preset amounts of catalyst suitable to cure said uniform

pasty liquid.

12. Process according to claim 11, characterized in that it comprises the following steps after said mixing step:
    -- curing step, during which said uniform pasty liquid is polymerized at low temperature by mixing with said catalyst;
    -- final step, during which the abrasive devices are extracted from said molds once they have been allowed to cure.

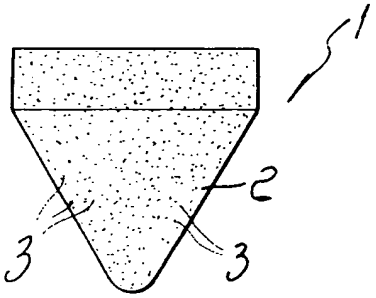

Fig. 1

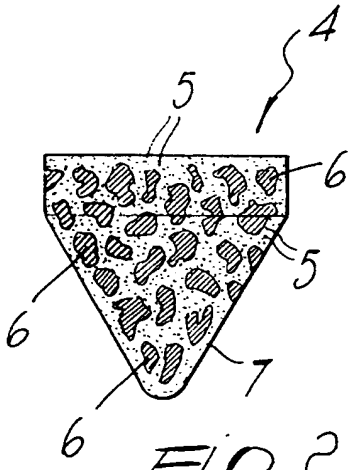

Fig. 2

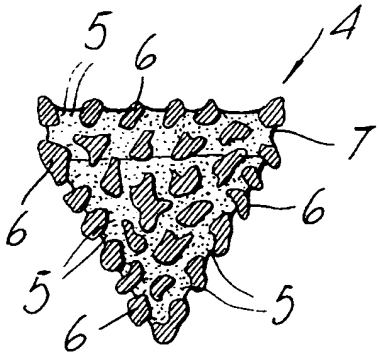

Fig. 3

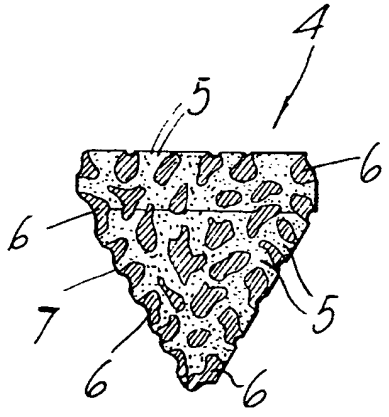

Fig. 4

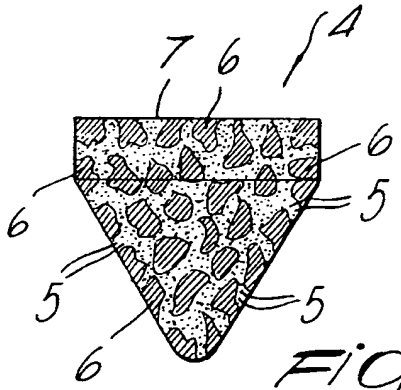

Fig. 5

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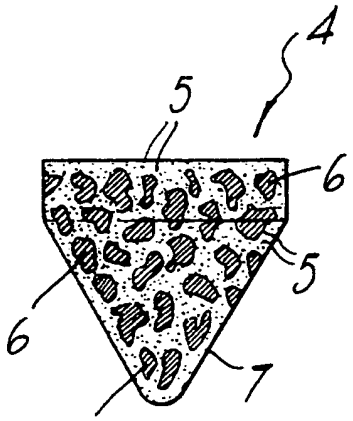

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number

EP 92 11 1976

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X A	DE-A-2 538 053 (CERATEX ENGINEERING LTD.) * the whole document * ---	1-5 7-12	B24D3/28 B24D3/34 B24D5/06 B24B31/14
X	FR-A-2 214 741 (OXY METAL FINISHING INTERNATIONAL S.A.) * the whole document * ---	1-5	
X	GB-A-2 018 811 (SIA SCHWEIZER SCHMIRGEL-UND SCHLEIF-INDUSTRIE AG.) * the whole document * ---	1-4	
A	EP-A-0 280 463 (MINNESOTA MINING AND MANUFACTURING COMPANY) * the whole document * ---	1-4	
A	US-A-3 613 317 (JOHN B. KITTREDGE AND RICHARD L. LARSON) * the whole document * ---	6,11,12	
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Y	SOVIET PATENTS ABSTRACTS Week 7843, 1978 Derwent Publications Ltd., London, GB; AN 78-J5034A 43 & SU-A-582 957 (VORON. POLY.) 8 December 1977 * abstract * ---	7-10	
A	AU-B-23 559 (GOTTFRIED TAUSS AND JAN WILLEM VANDEPOLL) * the whole document * --- -/--	1-4,7-12	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 MARCH 1993	MOLTO PINOL F.J.

CATEGORY OF CITED DOCUMENTS

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	GB-A-2 089 281 (ROTO-FINISH COMPANY INC.) * the whole document * -----	1-4,7-12	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)

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